

Experimental analysis of true left-handed behavior and transmission properties of composite metamaterials

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We report the true-left handed transmission of a composite metamaterial (CMM) consisting of periodically stacked split-ring resonator (SRR) and wire structures. In particular, the negative permeability response is demonstrated by comparing SRR and closed-split resonator structures. We confirm experimentally that the effective plasma frequency (negative permittivity cut-off) of the CMM is lower than the plasma frequency of wires.[1]

We further investigate the effect of intralayer and interlayer disorder to transmission spectrum of CMMs, arising from aperiodic fabrication of SRR layers and misaligned stacking. When the intralayer disorder becomes comparable to the periodicity, the magnetic gap of SRRs and consequently the left-handed transmission band of CMM shrinks and transmission intensity decreases significantly. On the other hand, the SRR transmission spectrum is rather immune to misalignment effects, which is more likely to occur.[2]

[1] K. Aydin, K. Guven, M. Kafesaki, L. Zhang, C. M. Soukoulis, and E. Ozbay, *Optics Letters*, **29**, 2623 (2004).

[2] K. Aydin, K. Guven, N. Katsarakis, C. M. Soukoulis, and E. Ozbay, *Optics Express*, **12**, 5896 (2004).